Life Transitions in the Waning of Physical Activity From Childhood to Adult Life in the Trois-Rivières Study

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Background: Several studies have reported an age-related decline of physical activity (PA). We examined the impact of 4 important transitional periods—adolescence, the beginning of postsecondary education, entry into the labor market, and parenthood—on the PA of participants in the Trois-Rivières quasi-experimental study.

Methods: In 2008, 44 women and 42 men aged 44.0 ± 1.2 years were given a semistructured interview; the frequency and duration of physical activities were examined during each of these transition periods. Subjects had been assigned to either an experimental program [5 h of weekly physical education (PE) from Grades 1 to 6] or the standard curriculum (40 min of weekly PE) throughout primary school.

Results: The percentage of individuals undertaking ≥5 h of PA per week decreased from 70.4% to 17.0% between adolescence and midlife. The largest decline occurred on entering the labor market (from 55.9% to 23.4%). At midlife, there were no significant differences of PA level between experimental and control groups. Men were more active than women at each transition except for parenthood.

Conclusions: Our results highlight a progressive non-linear decline of PA involvement in both groups. Promotion initiatives should target these periods to prevent the decline of PA.

Keywords: physical education, exercise, tracking, longitudinal study

Industrialized countries currently face an unprecedented prevalence of physical inactivity with associated obesity and other chronic health problems, including type II diabetes, coronary heart disease, hypertension, and cancer. Longitudinal studies have demonstrated strong links between a lack of physical activity (PA), cardiovascular risk factors, and overall mortality.

Scientists and health practitioners are thus seeking effective ways to promote adoption of a physically active lifestyle. Unfortunately, up to 50% of individuals who start an exercise program drop out in the first 6 to 8 weeks. Thus, the challenge is to motivate people not only to begin exercising, but also to make regular PA a long-term commitment. The determinants of PA are numerous, and the importance of individual factors varies from one individual to another and from one population to another. Notwithstanding the multiplicity of determinants, several longitudinal investigations and reviews have underlined that individuals who had a high level of PA or practiced organized sports in their youth were more likely to be active as adults.

To determine the stability of PA levels from childhood to adulthood (which researchers refer to as the tracking of PA), investigators typically calculate the correlation coefficients between 2 or more assessments of PA. Most studies have reported weak to moderate tracking of PA, as defined by correlation coefficients below 0.6. Generally, correlation coefficients have been higher when the interval between measurements was shorter and subjects were postpubescent at the baseline assessment. Moreover, physical fitness has shown stronger tracking than PA level. A dominant characteristic of almost all studies has been a progressive decline in PA as subjects became older, which Sallis refers to as “the most consistent finding in physical activity epidemiology.” Several authors have noted that this decrease is not linear. There seem to be critical periods during the life course where the decline is accelerated, followed by periods where the decrease proceeds more slowly. Although several authors have insisted on the necessity of developing a life-course approach in the promotion of PA, there is no clear consensus regarding which transition periods are the most important.

Although one of the main purposes of school-based physical education (PE) is to foster participation into lifetime physical activities, it is striking that only a small number of studies have analyzed the long term impacts of PE. In the National Longitudinal Study of Adolescent Health, each weekday that American adolescent attended PE classes was associated to a 5% lower risk of being overweight as an adult. Similarly, results from the Canadian National Longitudinal Survey of Children and Youth underlined that both normal weight and overweight
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... children were more likely to become active if they spent more time in PE classes.39

However, the Trois-Rivières Growth and Development Study remains, to our knowledge, the only investigation where the long-term impacts of an enriched PE curriculum have been specifically examined.36,40 During the quasi-experimental period, from 1970–1977, 546 participants had been assigned (on the basis of year of entry to a school) to either an experimental program offering 5 h of specialist-taught physical education (PE) per week from Grades 1 to 6, or a control group that received only the standard PE curriculum (40 min per week) taught by the home-room teacher. The study cohort included participants from urban and rural areas (Trois-Rivières and Pont-Rouge, respectively). Further details of the intervention41 and the socioeconomic characteristics42 of the initial sample are available elsewhere. At the end of the program, the experimental group showed significant advantages in psychomotor abilities, aerobic power, and muscular strength, with superior academic results.43,44 A first long-term follow-up of 253 participants was undertaken between 1995–1998.20,37,45

Our present purpose was to examine the impact upon PA of 4 transition periods, chosen based on Larouche’s literature review:46 1) puberty and associated entry into secondary school, 2) the beginning of postsecondary education, 3) entry into the labor market, and 4) parenthood. Previous studies have found major declines in PA levels associated with these transition periods.27,29,47–57 It was also anticipated that a high proportion of the participants had already experienced them. In the Quebec public school system, elementary school extends from kindergarten to Grade 6 and secondary school from Grade 7 through 11. Then, the options are to proceed to “CEGEP” (essentially comparable to a junior college) for 2 or 3 years (depending on the program), to learn a trade, or to enter the labor market directly. Consequently, for the purpose of this study, the beginning of postsecondary education (ie, transition period #2) was defined as entry to CEGEP. After CEGEP, students can proceed to university level courses. The second major objective of our study was to assess if enhanced PE throughout primary school can foster long-term adherence to a physically active lifestyle.

Methods

Participants

In 2008, research assistants from the Université du Québec à Trois-Rivières (UQTR) contacted individuals among the 253 participants to the first follow-up of the Trois-Rivières study. We were able to recruit 86 individuals (44 women and 42 men aged 44.0 ± 1.2 years). The decision to include 86 participants was partly based on cost-related issues. Of course, several potential participants could not be reached by the research assistants. When it was the case we contacted the next person on the list. The distribution of the participants into the different groups is illustrated in Figure 1. Each of these individuals gave informed consent to the present follow-up investigation, as approved by the institutional ethics committee.

Figure 1 – Flow of the participants to the follow-ups in the Trois-Rivières Study. The bottom row represents the participants in the current study, the row above the bottom row represents the participants in the first follow-up (1995–1998), and the upper two rows represent the initial sample (1970–1977).
Procedure

For the current study, 3 graduate students conducted semistructured individual interviews lasting 15 to 35 min. The graduate students were involved in the development of the interview canvas. The interviewers met each participant in person, either in Trois-Rivières or Pont-Rouge. The participants were asked to describe the weekly frequency and duration of each physical activity that they practiced immediately following each aforementioned transition periods. Before the interviews, the participants were instructed that physical activity includes leisure-time PA, organized sports, active transportation, household tasks, and work-related PA.58 The questions were mostly opened.

Analysis

Interviews were first recorded and transcribed by a clerk typist. A code was assigned to individual participants to maintain their anonymity. Recording problems resulted in the loss of 6 interviews, so that information on 80 subjects was available for analysis. Two coders (the first author and a research professional) examined the entire database independently, afterward discussing and reaching agreement on every passage they had coded differently. This control process was intended to uphold the credibility of analyses, and reduce the subjectivity of data.59–61 Qualitative data were captured in concise form on a Microsoft Excel worksheet; each passage was associated with the page number of the corresponding transcript. Such a strategy proved as efficient as more sophisticated qualitative data analysis tools.62 The “framework” approach developed by Ritchie and Spencer63 was adopted for data analysis; this methodology allowed both inductive and deductive theme categories.

Four categories were established according to the participants’ self-reported weekly PA volume: 1) inactive: no PA; 2) insufficiently active: < 150 min; 3) moderately active: 150–300 min; and 4) very active: > 300 min. The threshold of sufficient activity (150 min/week) was based on the recommendation of the American College of Sports Medicine and the American Heart Association.5 Based on the participants’ responses, seasonal physical activities such as ice hockey and baseball were practiced during half of the year, thus the reported frequency was divided by 2 to better reflect usual PA levels on an annual basis. The weekly PA volume was then calculated by the 2 coders.

Quantitative data were analyzed using SPSS 12.0 for Windows. The Mann-Whitney U test examined differences between experimental conditions and genders.64 To assess the significance of the monotonic decline of PA across the 4 transition periods, we used a test of isotonous variation proposed by Barlow and colleagues,65 in its Chi-square implementation. The test was applied to the successive proportions p (eg, proportion of participants accumulating > 300 min of PA weekly) modified through Fisher’s arc-sine transformation, “x = sin^1(p/2),” with approximate standard variance 1/(4n). In this condition, the test renders Chi-square values (noted χ^2; see Barlow et al,65 p. 117 to 120 or Laurencelle & Dupuis,66 p. 85 to 102) to be compared with appropriate critical values for the “simple order (ie, decreasing) model.” Barlow et al’s is one of the few statistical procedures implementing a test for nonlinear, rank-order model, suitable for our data structure.

Results

Our main finding was a sharp decline in PA level along major life events (Table 1). The proportion of individuals who claimed to be “very active” fell from 70.4% during adolescence to 17.0% when their first child was born (M χ^2 = 26,098; P < .01). During the same period, the percentage of inactive individuals rose from 2.8% to 23.4% (M χ^2 = 6705; P < .05). By the time a family had been begun, 60.1% of participants were insufficiently active. When questioned about factors that led to a significant change in their PA levels occurred, several participants mentioned that they did not have time to exercise because of a combination of issues related to work, studies, parental responsibilities and other chores. For example, one commented, “Of course, the transition from studies to work changes lifestyle a lot [. . .] then I had 3 children in a very short time frame.” Another said, “Negatively, what influenced [my level of physical activity] is work, sometimes my spouse, my house, and my kid. Positively, unemployment, living in an apartment, being single, or having a partner who does sports.” Some participants reduced their PA level immediately after the birth of their first child, but increased it afterward. For example, one father mentioned, “It was a question of priorities. At one moment, it was the children; but later on, I started to be concerned about my weight and to get back in shape.”

It is noteworthy that some of the participants’ reports on their PA at certain transition periods were too imprecise to allow the classification of their PA level into 1 of the categories, and some of them were not given to live certain transition periods (eg, parenthood); hence the missing data in the tables.

Differences Between Groups

As reported previously,41 participants from the experimental group were much more active than the control during primary school. In the interview, they were more likely to specify that their PE classes motivated them to be active during childhood and adolescence (30.8% vs. 6.3%; χ^2 = 5.9; df = 1; P = .015). One woman said, “If I had not participated to such a project, I am not sure that I would have done that much sport as a kid.” Others also indicated that their physical educator had a strong influence on their PA levels. For example, one man said, “No matter what activity we did with [the professor], it was fun. I really enjoyed it.” On the other hand, one participant
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from the control group said, “I was a little bit jealous of the group that did PE 5 times per week.”

Nevertheless, the Mann-Whitney test revealed no significant differences in PA levels between experimental and control groups during the first 3 transition periods. However, immediately following the birth of their first child, control participants reported a higher PA level (U = 171; $P = .022$). During this period, experimental participants were over-represented in the “inactive” and “insufficiently active” (67.9%) categories while control participants were more frequently classified as “moderately active” or “very active” (73.7%).

**Differences Between Genders**

Males were significantly more active than females during adolescence (U = 363.5; $P < .001$), postsecondary education (U = 236.5; $P < .01$), and at entry into the labor market (U = 280; $P < .001$; Table 2). A higher proportion of women than men (69.7% vs. 31.3%; $\chi^2 = 8.9; df = 1; P = .003$) reported at least 1 barrier to PA during childhood and adolescence, including lack of time, lack of interest, lack of skills, inactive friends, family constraints, etc. For example, one woman said, “I don’t know why, but I was never tempted to learn how to play sports.” Another woman said, “I would have liked to do figure skating, but my parents could not drive me.” With the arrival of children, the difference became statistically non significant, although the trend was still in the same direction (U = 190.5; $P = .082$). Some fathers mentioned that they reduced their PA level following the birth of their first child. One father from the experimental group mentioned, “Well, when we had kids, we took more time to worry about them than about ourselves.”

**Discussion**

The primary objectives of our investigation were to analyze the impact of 4 major life events on the evolution of PA from childhood to adult life, and to assess the influence of the Trois-Rivières experimental PE program. Our results revealed a clear decline of PA with age, in agreement with most longitudinal studies.\textsuperscript{22,27–29} The proportion of “very active” participants decreased by almost 75% between secondary school and the arrival of children. Concomitantly, there was an almost 10-fold increase in the prevalence of physical inactivity. In accordance with earlier reports,\textsuperscript{13,28,30} the decline of PA was not linear; the most important negative factor was entry into the labor market, when the percentage of “very active” individuals dropped from 55.9% to 23.4%. The influence of each transition is discussed further below.

**Transition From Primary to Secondary School**

Many authors have reported a dramatic reduction in PA on moving from primary to secondary school,\textsuperscript{29,47–50,67} although it is difficult to disentangle the respective influences of a change in educational system and the onset of puberty. In our investigation, over 85% of participants claimed that they were still “sufficiently active” during adolescence. However, many of them had only vague memories of their childhood behaviors. For example, one participant said, “It’s been a long time, I don’t remember it much. I remember that I liked it and, basically, I always enjoyed sport. In my memories, it’s vague. We’re talking of [events that occurred] about 35 years ago.” Theoretically, PA is likely to have declined between childhood and adolescence, at least among the experimental participants, because with 5 h of weekly PE, they would all have been classified in the “very active” category while they were in primary school.

**Beginning of Postsecondary Education**

For those participants having moved into postsecondary education, the percentage of inactive participants increased almost 4-fold, while the proportion of “very active” individuals fell by about 15%. Other researchers have also observed a decline in PA during this transition.\textsuperscript{31–35} Many factors might be responsible for this reduction in PA levels. Firstly, for many students the necessity of combining work with academic studies greatly reduces the free time previously available for PA. Thus one participant stated, “When I was in Junior B hockey, I dropped out after 3 months, because I was

<table>
<thead>
<tr>
<th>Categories</th>
<th>Adolescence</th>
<th>Postsecondary studies</th>
<th>Entry into the labor market</th>
<th>Parenthood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactive (no PA)</td>
<td>2.8%</td>
<td>10.2%</td>
<td>9.4%</td>
<td>23.4%</td>
</tr>
<tr>
<td>Insufficiently active (&lt;150 min/week)</td>
<td>11.3%</td>
<td>15.2%</td>
<td>29.7%</td>
<td>36.2%</td>
</tr>
<tr>
<td>Moderately active (150–300 min/week)</td>
<td>15.5%</td>
<td>18.6%</td>
<td>37.5%</td>
<td>23.4%</td>
</tr>
<tr>
<td>Very active (&gt;300 min/week)</td>
<td>70.4%</td>
<td>55.9%</td>
<td>23.4%</td>
<td>17.0%</td>
</tr>
</tbody>
</table>

_Note._ Data are presented as percentages because the number of participants varied from one transition to another. For example, some participants did not become parents.
studying and I started to consider that it was difficult to reconcile both ends.” Secondly, the move to another city for postsecondary study is likely to reduce PA.30 One female participant explained why she abandoned sports after leaving Pont-Rouge: “Ah, well, I was going to CEGEP there and, I mean, you leave home, lifestyle changes . . . you change friends . . . you’re no longer around.” In addition, Gyurcsik and colleagues reported that the number of perceived barriers to PA increased continuously from Grade 7 to the first year of university.68 A lack of self-efficacy to cope with perceived barriers to PA could also influence the relationship between perceived barriers and PA levels.69

**Entry Into the Labor Market**

Previous studies have observed significant declines in PA when participants entered the labor market.54–56 In our study, this transition was associated with the most significant decline in PA. Many participants justified their reduction of PA in terms of a lack of time and fatigue resulting from their work. For example, one participant mentioned, “I work 40 hours per week and sometimes you’re tired and you don’t want to [exercise].” Others suggested that acquisition of a car led to a reduction of active transportation, and thus a decrease in total PA. For example, one female participant explained, “When I bought a car, it was really the end of my sporting activities. I no longer wanted to, I had no time to walk or to bike. . . . Yes, I had a car, so I never used the bike again from that time.” Other epidemiological studies have noted strong associations between active commuting and total PA.20,71 Finally, several individuals reported logistic problems, including, for example, difficulty in getting access to a hockey arena at reasonable hours. Such schedule-related problems have previously been documented by Michaud and colleagues.52

**Parenthood**

After the arrival of children, almost 25% of participants reported that they were inactive, and 60.1% failed to accumulate 150 minutes of physical activity, as recommended by the American College of Sports Medicine and the American Heart Association.2 Such rates are comparable to American self-reported data.13 Many participants suggested that they lacked time to be active because of the need to take care of their children. One female participant explained her low PA as follows: “We have a lot of things to do, the kids, the house to take care of. I didn’t take time for myself; we give time for the children, the house. At the end of the day, we don’t want to [exercise].” Another said, “Before the children, I took a lot more workout sessions, more intense sessions, because I was alone with my husband. Everything was simpler, we were only two.” Other researchers have also reported that parenthood is associated with a significant decrease in PA.54,56,57,72

**Impact of the Experimental Program on PA Behavior**

In the previous follow-up of Trois-Rivières study participants, women from the experimental group were more active than controls when they were 35 years of age.73 However, our present results suggest that this advantage vanished over the following decade. Thus, it appears that exercise habits established in childhood do not necessarily ensure that individuals will maintain a high level of PA throughout adult life, even though several theoretical
models have insisted on the importance of establishing the roots of a healthy and active lifestyle during childhood or adolescence.74,76 This finding is noteworthy given the importance of maintaining a high level of PA to prevent cardiovascular events, chronic diseases, cognitive impairments and all-cause mortality.56,77–79

The absence of significant differences of PA between the experimental and control groups could derive from many factors. Firstly, the experimental program ended at entry to high school, which is known to be a critical period in the evolution of PA behaviors. Secondly, Dale and colleagues have reported that most adolescents do not compensate for the cessation of compulsory PE in the upper grades of high school by a spontaneous increase in their PA.80

It has previously been suggested that the benefits of PE and school sports may be mediated by the nature of the interactions between the individual and their peers, parents, and PE teachers.17,81 Using semistructured interviews, Thompson and colleagues did a 25-year follow-up of the Saskatchewan Growth and Development Study. Their results suggested a polarization of behavior in adolescence: active adolescents were likely to maintain a high PA level into adulthood, whereas those who reduced their exercise level were prone to become sedentary adults.81 However, in our study, the proportion of “very active” individuals during adolescence was still very high. In addition, in the first follow-up, the participants from the experimental group reported more favorable attitudes and intentions toward practicing PA than their control counterparts.37 Finally, the relationship between the experimental program and PA level at follow-up has likely been influenced by barriers and motivational elements, including the environment.12,26,69

Study Weaknesses and Strengths

The retrospective design of our study is a potential source of bias, because the participants’ memories of their PA level during childhood were necessarily imprecise. This may explain why, unlike other researchers, we did not observe a major impact of the transition from primary to secondary school. The timing of the transition periods may differ considerably between participants; for example, the birth of their first child could have occurred during postsecondary studies or a long time after entry on the labor market. This may influence the impact of these transition periods on PA levels. Other limitations of self-reported PA include measurement error and social desirability,82,83 and the lack of control for potential confounding variables such as socioeconomic status. However, in our retrospective investigation, it would not have been possible to use an objective method such as accelerometry. Selection bias may also have influenced our results, because several participants from the original cohort could not be reached and others were unwilling to participate in the follow-up. Hence, the generalizability of our observations is limited because we were unable to question a random sample of our original population.

Despite its weaknesses, we believe our study makes a significant contribution to understanding the long-term impacts of an enriched PE program. Most previous articles have focused on only one transition, and have used a cross-sectional design which cannot distinguish the effects of aging from secular tendencies.32,33 Moreover, tracking studies typically evaluate the stability of PA between 2 or more dates, but do not consider the intervening events.18 The interviews allowed a more in-depth examination of the events that occurred during the transition periods which were associated to a modification of PA behaviors. Our sample size also ensures the saturation of data, which, in qualitative studies, determines the point where the addition of new data no longer adds to comprehension of the phenomenon.59 Furthermore, the control process adopted when analyzing the interviews contributes to the credibility of our analyses. Finally, the Trois-Rivières study remains the only investigation where the long-term impacts of a PE intervention have been assessed quasi-experimentally.36,40

Conclusion

These results add to the body of evidence indicating a nonlinear age-related decline of PA levels from adolescence to midlife. In our Québécois sample, the proportion of “very active” participants (ie, over 5 h of PA per week) dropped from 70.4% to 17.0%. The most dramatic decrease was seen on entering the labor market, when the percentage of “very active” participants fell from 55.9% to 23.4%. Moreover, by the age of around 44 years, our experimental participants showed no benefit from their additional PE in primary school.

These findings are particularly worrisome given the low proportion of children and adolescents that meet physical activity guidelines.84,85 For example, in the 34 countries who participated to the Health Behavior in School-age Children study (N = 137,593 children aged 10–16), the proportion of children reporting at least 60 minutes of PA on 5 of more days of the week ranged from 19.3 to 49.5%.85 Interestingly, a significant negative association between PA and BMI was noted in 88% of these countries. In addition, the prevalence of cardiovascular disease risk factors, including type II diabetes, elevated cholesterol, and hypertension, is increasing in the pediatric population.1 Given these trends, Shephard86 has argued that a new investigation like the Trois-Rivières study is urgently needed. Such a study should include objective measurements of PA levels and should ideally be extended to secondary school, where a major decline of PA levels has been observed by several researchers.67

Altogether, our findings suggest that establishing the habit of being physically active during childhood is not sufficient to ensure that individuals will remain...
active in adulthood. Therefore, like other researchers,31–33 we conclude that initiatives aimed at maintaining or increasing PA may be warranted during these important transition periods.

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References


